

EXCESS ENERGY CELL FINAL REPORT

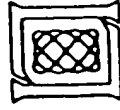
25 APRIL 1995

C. W. HALDEMAN, E. D. SAVOYE, G. W. ISELER, H. R. CLARK

OUTLINE

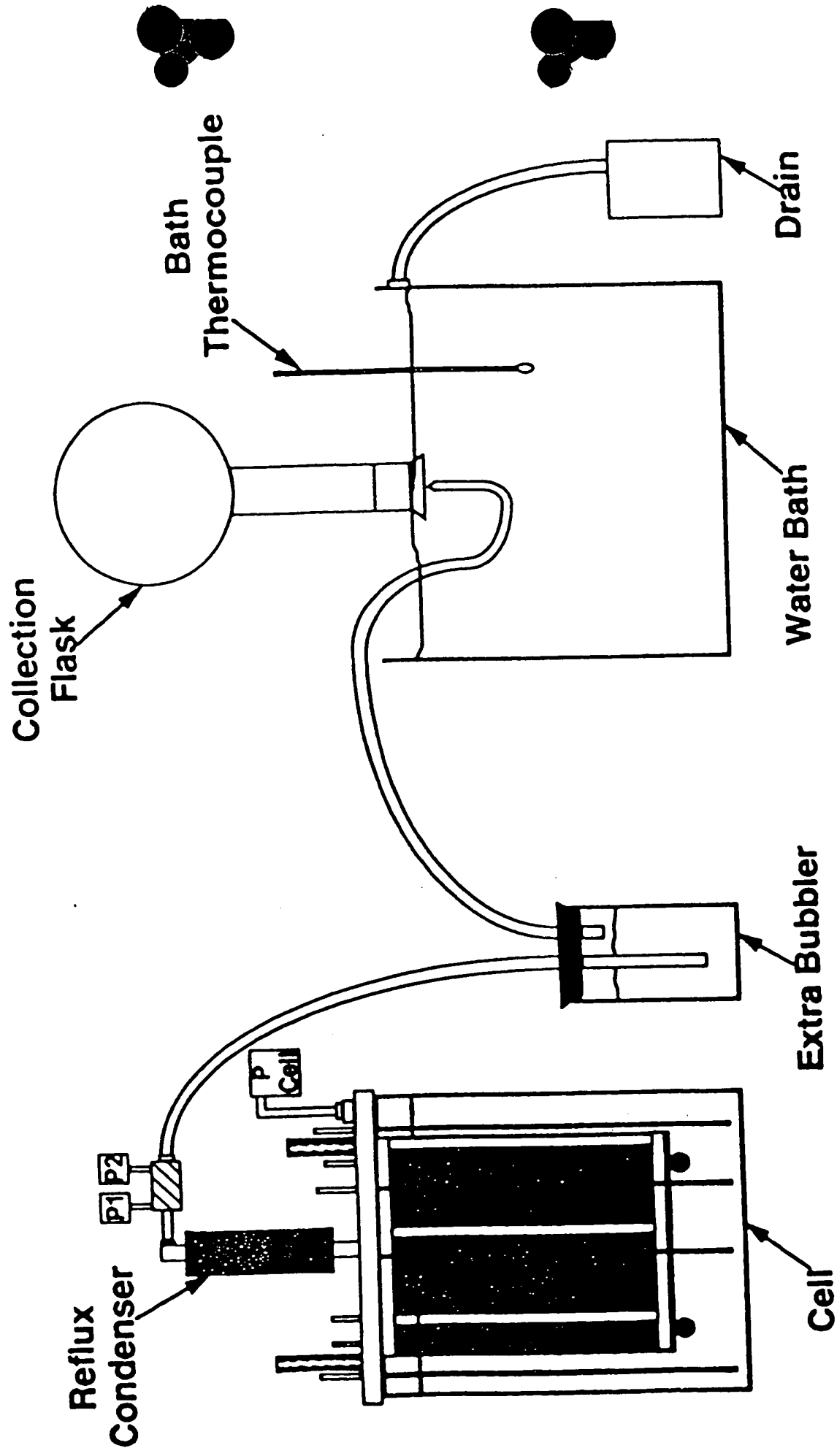
- REVIEW
- CHANGES SINCE LAST REPORT
 - RETURN TO ROOM THERMAL ENVIRONMENT
 - RE-WOUND CELL
 - RESIDUAL GAS ANALYSIS
- ENERGY MEASUREMENTS
- GAS MEASUREMENTS
- CONCLUSIONS

APPENDIX A

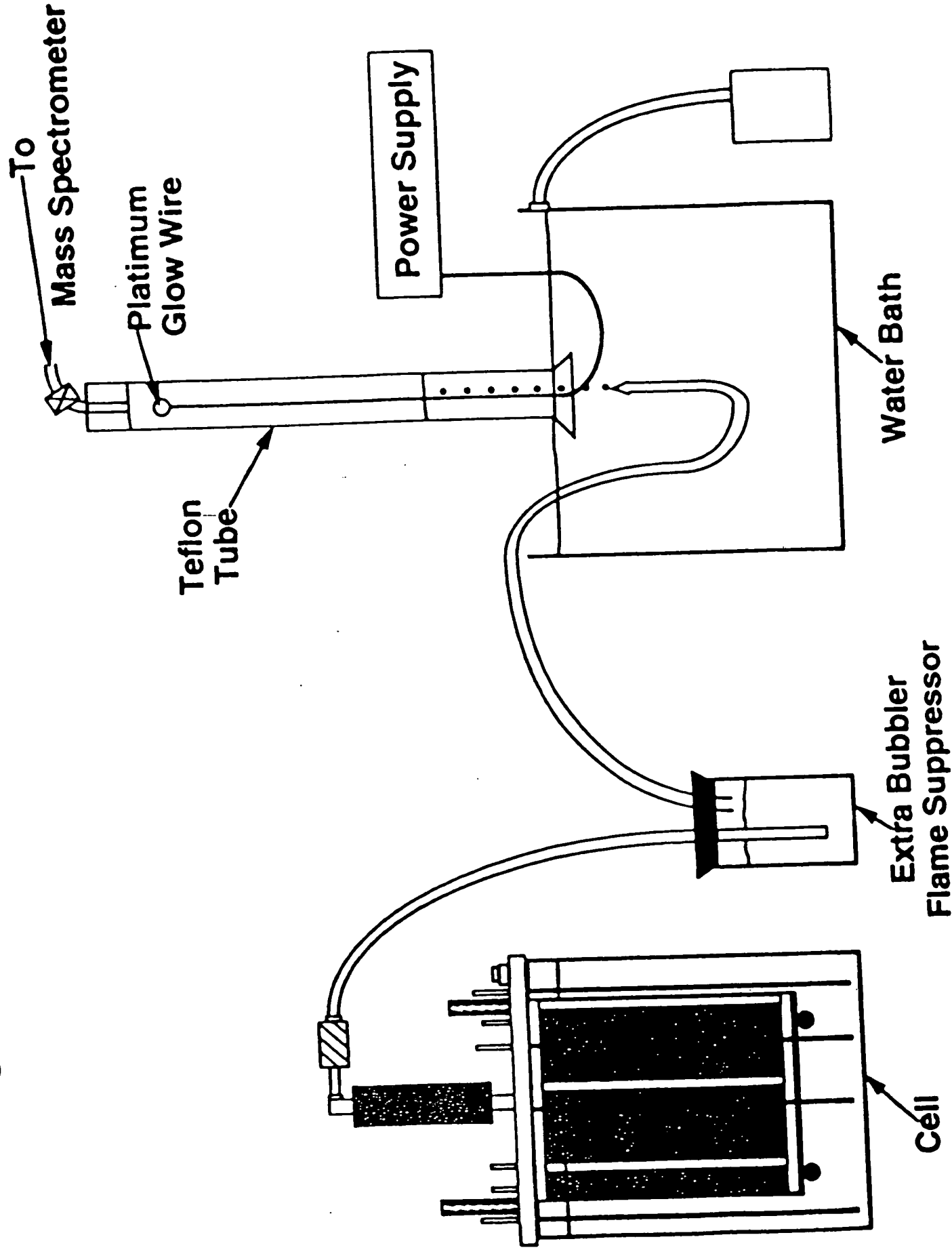


•ec/chuck/4/20

Sealed Cell Layout



Gas Collection With Combustion Tube



SUMMARY OF CELLS ASSEMBLED

<u>CELL #</u>	<u>CATHODE</u>	<u>ANODE</u>	<u>C/A RATIO</u>	<u>RESULTS</u>
1	ANNEALED #41 NICKEL 1.8 lbs 52000 cm ²	PLATINIZED Ti 100 cm ²	520: 1	NO EXCESS ENERGY
1A	SAME WIRE HEAT TREATED IN H ₂ 770°C	SOFT NICKEL SHEET 3000 cm ² PLATINIZED Ti 100 cm ²	17: 1	NO EXCESS ENERGY
2	HARD DRAWN 0.5 mm NICKEL 16,000 cm ²	SAME	5: 1	5 → 10% EXCESS ENERGY
2A	NEW WINDING HARD DRAWN 0.5 cm ² NICKEL 15,000 cm ²	PLATINIZED Ti SHEET 3100 cm ²	5: 1	5 → 30% EXCESS ENERGY
3	HARD DRAWN - SCRATCHED #44 NICKEL 190,000 cm ² (0.002 in.) 0.05 cm dia.	SAME	61: 1	20 → 50% EXCESS ENERGY
4	#46 HARD DRAWN SMOOTH NICKEL WIRE 240,000 cm ²	SAME	75: 1	20 → 1400% EXCESS ENERGY 4 x VI INPUT



• oca/N/chuck/A/21

OCTOBER 1994 PLANS

1. USE SEALED SYSTEM RECOMBINER / CONDENSER
TO COLLECT GAS
2. REWIND CELL WITH SMOOTH #46 WIRE
3. USE WET CHEMICAL GAS ANALYZER
4. CONTINUE TO LOOK FOR HIGHER EXCESS ENERGY
AND CHARACTER OF RESIDUAL GAS



DOE/CHUCK/4/24

RE-WOUND CELL

• CATHODE - 4.7 lbs #46 NICKEL WIRE
Dia. (0.00157 inch) 0.00399 cm

SURFACE AREA 240,000 cm²
CURRENT DENSITY 41 μ a/cm² @ 10a

• ANODE - 5 FOLDED SHEETS Pt PLATED Ti
15.2 x 20.3 cm

SURFACE AREA 3200 cm²
CURRENT DENSITY 32 ma/cm² @ 10a
75:1 CATHODE: ANODE RATIO

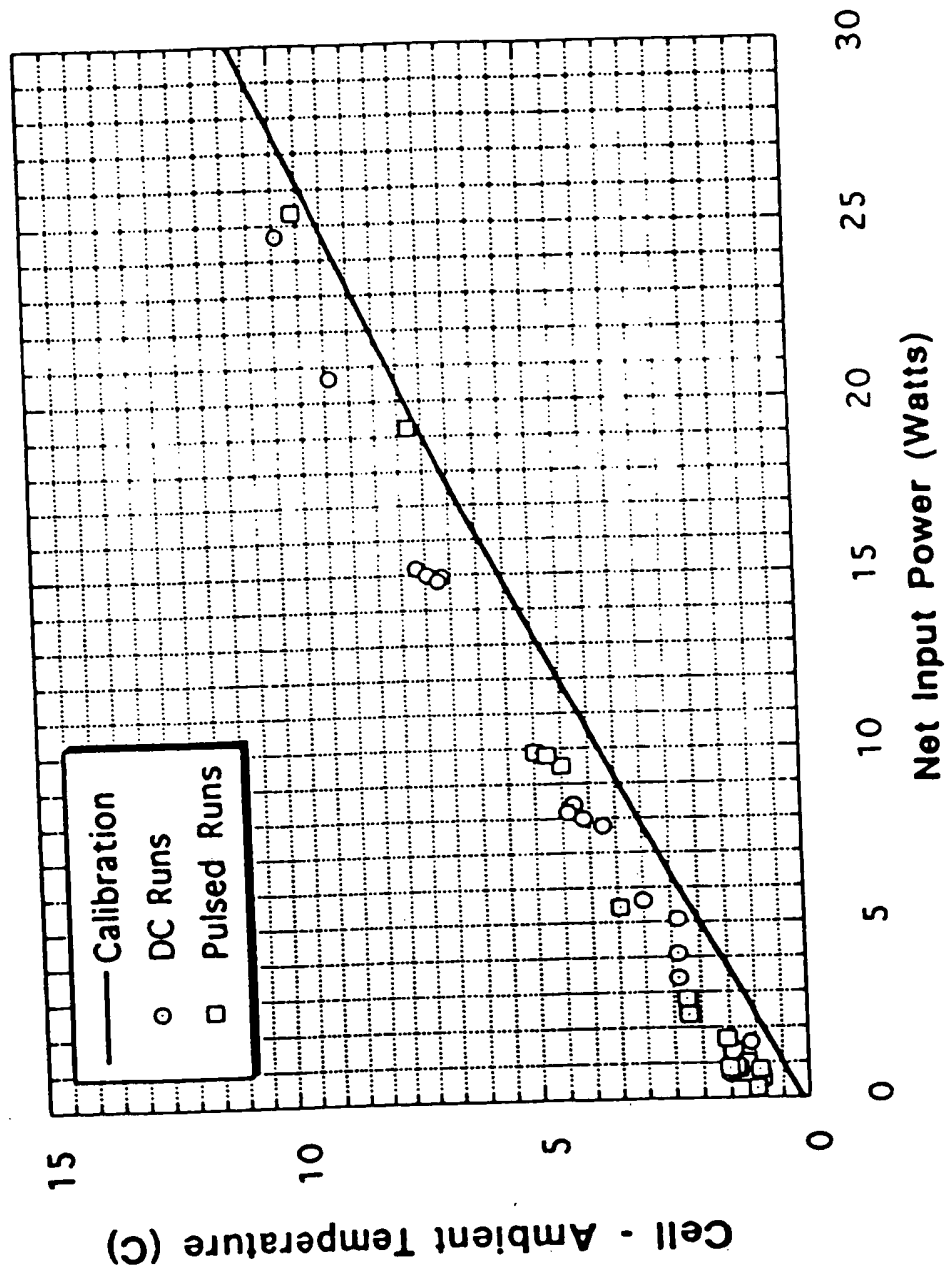
• ELECTROLYTE - 16 l 0.6 M K₂ CO₃
IN LAB DI WATER

GAS FLOW ABSOLUTE MEASUREMENT

- **DIRECT WATER DISPLACEMENT**
 - 2000 \pm 0.5 cc VOLUMETRIC FLASK
- **WATER BATH TEMPERATURE \pm 0.1°C**
- **TIME MEASUREMENT \pm 0.02 sec**
- **BAROMETRIC PRESSURE**
 - NATIONAL WEATHER SERVICE BAROMETER - CORRECTED
FOR TEMPERATURE AND LATITUDE \pm 0.1 mm
- **MEASURED VOLUME CORRECTED FOR**
 - TEMPERATURE
 - PRESSURE
 - WATER VAPOR CONTENT



Electrolytic Cell Data Results




4/20/05

Electrolytic

Temperatures

File Name Run No.	V (Volts)	I (Amps)	P (Watts)	Duty Cycle	Load (Hz)	Bus (Volts)	Cell (C)	Ambient (C)	ΔI (C)	H ₂ O Power Correction (watts)	P _{in} (Watts)	Output Power (watts)	Δ Power (watts)	Output/P _{in} (F=1)	Output/P _{in} (F=1)	Ordered (times)
Run265	2.630	4.895	14.136	100%	0	0	24.159	20.406	3.753	0.0796	7.776	10.379	2.603	133.5%	155.1%	0.73
Run266	2.693	5.014	14.505	100%	0	0	23.769	19.656	4.113	0.1125	7.992	11.385	3.393	142.5%	161.9%	0.76
Run267	2.758	5.126	14.158	100%	0	0	26.913	20.202	6.711	0.1761	7.994	cal check	N/A	N/A	N/A	
Run268	2.740	5.217	14.295	100%	0	0	31.453	20.648	10.805	0.3006	7.658	cal check	N/A	N/A	N/A	0.61
Run269	2.745	5.781	15.766	100%	0	0	34.92	20.73	14.19	0.2325	8.401	cal check	N/A	N/A	N/A	0.74
Run290	2.920	4.999	14.597	100%	0	0	23.882	19.597	4.285	0.1331	8.169	25.06	4.386	121.2%	134.1%	
Run291a	3.367	10.010	33.704	100%	0	0	28.662	19.75	8.912	0.1709	20.674	25.06	N/A	N/A	N/A	0.70
Run292	3.359	10.009	33.620	100%	0	0	30.52	20.637	9.893	0.2416	20.394	28.043	3.362	113.6%	122.6%	0.84
Run293	3.488	11.500	40.112	100%	0	0	30.455	20.52	9.935	0.3651	24.681	12.2	4.032	149.4%	170.6%	
Run294	2.919	4.998	14.589	100%	0	0	24.184	19.78	4.404	0.0417	8.168	12.208 W heaters ad	N/A	N/A	N/A	
Run295	2.758	4.545	12.535	100%	0	0	26.013	19.852	6.161	0.1097	8.006	1.718 W heaters ad	N/A	N/A	N/A	
Run296a	2.869	4.768	13.679	100%	0	0	24.726	20.36	4.366	0.2600	7.308	6.68	3.179	163.6%	207.9%	0.90
Run297	2.930	2.766	7.275	100%	0	0	21.9	19.518	2.384	0.1158	3.401	2.232 W heaters ad	N/A	N/A	N/A	
Run298	2.869	2.679	6.625	100%	0	0	22.620	19.964	2.676	0.1212	3.250	4.603 W heaters ad	N/A	N/A	N/A	
Run299	2.533	2.676	6.528	100%	0	0	23.906	19.571	4.335	0.0993	3.299	1.076 W heaters ad	N/A	N/A	N/A	
Run300	2.664	2.676	6.602	100%	0	0	22.467	19.625	2.862	0.1172	3.351					0.79
Run301 - Data Lost due to computer failure																
Run302	3.225	7.906	25.497	100%	0	0	26.803	19.604	7.199	0.0700	16.196	20.119	4.924	132.4%	147.2%	0.77
Run303	3.220	7.903	25.446	100%	0	0	26.517	19.545	6.972	0.1148	14.994	19.47	4.476	129.9%	142.9%	1.66
Run304-low P	1.919	2.309	2.000	20%	6	2.6	21.099	19.669	1.42	0.0356	0.669	3.926	3.259	567.3%	N/A	2.06
Run304-High P	1.923	2.259	2.000	20%	6	2.6	21.185	19.662	1.503	0.0035	0.736	4.155	3.417	563.1%	N/A	1.29
Run305	2.080	3.712	4.809	20%	6	3.3	22.158	19.917	2.241	0.0303	2.795	6.185	3.390	221.3%	136.4%	0.72
Run306a	3.169	8.086	26.691	100%	0	0	27.004	20.336	6.668	0.0761	14.936	16.801	3.663	124.5%	N/A	1.51
Run307	2.046	3.214	4.037	20%	6	2.6	21.991	19.775	2.216	0.0094	2.354	6.116	3.762	259.8%	N/A	1.63
Run308	1.867	2.526	2.207	10%	6	2.6	21.481	20.004	1.457	0.0050	1.293	4.029	2.736	311.5%	N/A	1.62
Run309	1.933	2.226	2.462	20%	6	2.6	21.796	20.594	1.202	0.0039	0.684	3.33	2.661	299.6%	N/A	2.43
Run310	1.802	1.808	1.373	10%	6	2.6	22.395	20.182	2.213	0.0036	0.811	2.491	1.941	452.9%	N/A	2.19
Run311	1.784	1.853	1.428	10%	6	2.6	21.503	20.808	0.895	0.0029	0.550	2.923	2.216	413.1%	625.3%	1.50
Run312	1.787	1.526	1.137	10%	6	2.6	20.69	19.837	1.053	0.0064	0.707	2.005	1.871	1498.6%	3382.6%	4.26
Run313	1.850	0.999	1.948	100%	0	0	19.934	19.217	0.717	0.0017	0.134	3.068	N/A	N/A	N/A	N/A
Run314	1.894	0.276	0.470	100%	0	0	21.151	19.398	1.753	0.0015	0.166	3.068 W heaters ad	N/A	N/A	N/A	N/A
Run315a	1.892	0.276	0.467	100%	0	0	21.785	19.300	2.485	0.0015	0.202	3.068 W heaters ad	N/A	N/A	N/A	N/A
Run316	1.890	0.276	0.466	100%	0	0	21.353	20.247	1.106	0.0142	1.589	3.068	1.479	193.1%	230.2%	0.71
Run317	2.150	2.002	4.304	100%	0	0	22.08	19.669	2.391	0.0266	4.102	6.4021	2.497	160.9%	177.6%	0.73
Run318	2.526	3.680	9.940	100%	0	0	38.979	20.499	18.48	0.3847	53.007	6.539	1.014	101.9%	110.8%	0.68
Run319	3.967	20.000	79.140	100%	0	0	21.943	19.574	2.369	0.0162	5.090	8.324	1.440	126.5%	105.4%	0.61
Run320	2.543	3.167	8.054	100%	0	0	23.616	20.601	3.014	0.0309	5.631	4.109	2.993	147.6%	161.7%	0.75
Run321	2.776	3.999	11.097	100%	0	0	21.321	19.636	1.486	0.0048	0.666	3.266	3.264	460.6%	N/A	2.42
Run322	1.812	2.084	1.897	10%	6	2.6	20.673	19.408	1.175	0.0035	1.018	3.266	2.238	319.7%	N/A	1.66
Run323	1.934	2.186	1.763	10%	12	2.6	21.05	19.666	1.366	0.0046	0.794	3.266	2.955	472.0%	N/A	2.34
Run324	1.809	2.018	1.601	10%	4	2.6	21.145	19.746	1.397	0.0040	0.674	3.865	2.991	442.1%	N/A	2.27
Run325	1.824	2.129	1.700	10%	6	2.6	21.296	19.762	1.644	0.0066	1.677	4.268	2.891	254.6%	N/A	1.49
Run326	1.936	3.057	2.876	10%	6	3.0	21.296	19.762	1.644	0.0066	1.677	4.268	2.891	254.6%	N/A	1.21
Run326a	2.169	6.216	7.901	10%	6	4.0	23.383	19.931	3.452	0.0115	5.430	9.541	4.111	175.7%	N/A	1.21
Run327	2.169	6.216	7.901	10%	6	4.0	23.383	19.931	3.452	0.0115	5.430	9.541	4.111	175.7%	N/A	1.21
Run328 - This run no. accidentally shipped																
Run329	2.326	8.699	13.418	10%	6	4.6	24.601	19.61	4.991	0.0163	9.866	13.849	3.963	140.1%	N/A	1.03
Run330	1.828	2.034	1.600	10%	6	2.6	21.27	20.328	0.942	0.0041	0.790	2.610	1.829	331.6%	N/A	1.64
Run331/Net lid	3.744	6.032	30.072	100%	0	0	26.296	19.727	6.669	0.0391	17.236	16.310	1.081	106.3%	112.7%	0.61

The Following Runs are the Start of Experiments with the new Smooth Needle and Cartridge																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
Run Name (Run No.)	Bar. Pressure (Torr)	Bar. Pressure (calibrated) (Torr)	P _{cell} (psig)	P ₁ (psig)	P ₂ (psig)	P ₃ (psig)	P ₄ (psig)	P ₅ (psig)	P ₆ (psig)	P ₇ (psig)	P ₈ (psig)	P ₉ (psig)	P ₁₀ (psig)	P ₁₁ (psig)	P ₁₂ (psig)	P ₁₃ (psig)	P ₁₄ (psig)	P ₁₅ (psig)	P ₁₆ (psig)	P ₁₇ (psig)	P ₁₈ (psig)	P ₁₉ (psig)	P ₂₀ (psig)	P ₂₁ (psig)	P ₂₂ (psig)	P ₂₃ (psig)	P ₂₄ (psig)	P ₂₅ (psig)	P ₂₆ (psig)	P ₂₇ (psig)	P ₂₈ (psig)	P ₂₉ (psig)	P ₃₀ (psig)	P ₃₁ (psig)	P ₃₂ (psig)	P ₃₃ (psig)	P ₃₄ (psig)	P ₃₅ (psig)	P ₃₆ (psig)	P ₃₇ (psig)	P ₃₈ (psig)	P ₃₉ (psig)	P ₄₀ (psig)	P ₄₁ (psig)	P ₄₂ (psig)	P ₄₃ (psig)	P ₄₄ (psig)	P ₄₅ (psig)	P ₄₆ (psig)	P ₄₇ (psig)	P ₄₈ (psig)	P ₄₉ (psig)	P ₅₀ (psig)	P ₅₁ (psig)	P ₅₂ (psig)	P ₅₃ (psig)	P ₅₄ (psig)	P ₅₅ (psig)	P ₅₆ (psig)	P ₅₇ (psig)	P ₅₈ (psig)	P ₅₉ (psig)	P ₆₀ (psig)	P ₆₁ (psig)	P ₆₂ (psig)	P ₆₃ (psig)	P ₆₄ (psig)	P ₆₅ (psig)	P ₆₆ (psig)	P ₆₇ (psig)	P ₆₈ (psig)	P ₆₉ (psig)	P ₇₀ (psig)	P ₇₁ (psig)	P ₇₂ (psig)	P ₇₃ (psig)	P ₇₄ (psig)	P ₇₅ (psig)	P ₇₆ (psig)	P ₇₇ (psig)	P ₇₈ (psig)	P ₇₉ (psig)	P ₈₀ (psig)	P ₈₁ (psig)	P ₈₂ (psig)	P ₈₃ (psig)	P ₈₄ (psig)	P ₈₅ (psig)	P ₈₆ (psig)	P ₈₇ (psig)	P ₈₈ (psig)	P ₈₉ (psig)	P ₉₀ (psig)	P ₉₁ (psig)	P ₉₂ (psig)	P ₉₃ (psig)	P ₉₄ (psig)	P ₉₅ (psig)	P ₉₆ (psig)	P ₉₇ (psig)	P ₉₈ (psig)	P ₉₉ (psig)	P ₁₀₀ (psig)	P ₁₀₁ (psig)	P ₁₀₂ (psig)	P ₁₀₃ (psig)	P ₁₀₄ (psig)	P ₁₀₅ (psig)	P ₁₀₆ (psig)	P ₁₀₇ (psig)	P ₁₀₈ (psig)	P ₁₀₉ (psig)	P ₁₁₀ (psig)	P ₁₁₁ (psig)	P ₁₁₂ (psig)	P ₁₁₃ (psig)	P ₁₁₄ (psig)	P ₁₁₅ (psig)	P ₁₁₆ (psig)	P ₁₁₇ (psig)	P ₁₁₈ (psig)	P ₁₁₉ (psig)	P ₁₂₀ (psig)	P ₁₂₁ (psig)	P ₁₂₂ (psig)	P ₁₂₃ (psig)	P ₁₂₄ (psig)	P ₁₂₅ (psig)	P ₁₂₆ (psig)	P ₁₂₇ (psig)	P ₁₂₈ (psig)	P ₁₂₉ (psig)	P ₁₃₀ (psig)	P ₁₃₁ (psig)	P ₁₃₂ (psig)	P ₁₃₃ (psig)	P ₁₃₄ (psig)	P ₁₃₅ (psig)	P ₁₃₆ (psig)	P ₁₃₇ (psig)	P ₁₃₈ (psig)	P ₁₃₉ (psig)	P ₁₄₀ (psig)	P ₁₄₁ (psig)	P ₁₄₂ (psig)	P ₁₄₃ (psig)	P ₁₄₄ (psig)	P ₁₄₅ (psig)	P ₁₄₆ (psig)	P ₁₄₇ (psig)	P ₁₄₈ (psig)	P ₁₄₉ (psig)	P ₁₅₀ (psig)	P ₁₅₁ (psig)	P ₁₅₂ (psig)	P ₁₅₃ (psig)	P ₁₅₄ (psig)	P ₁₅₅ (psig)	P ₁₅₆ (psig)	P ₁₅₇ (psig)	P ₁₅₈ (psig)	P ₁₅₉ (psig)	P ₁₆₀ (psig)	P ₁₆₁ (psig)	P ₁₆₂ (psig)	P ₁₆₃ (psig)	P ₁₆₄ (psig)	P ₁₆₅ (psig)	P ₁₆₆ (psig)	P ₁₆₇ (psig)	P ₁₆₈ (psig)	P ₁₆₉ (psig)	P ₁₇₀ (psig)	P ₁₇₁ (psig)	P ₁₇₂ (psig)	P ₁₇₃ (psig)	P ₁₇₄ (psig)	P ₁₇₅ (psig)	P ₁₇₆ (psig)	P ₁₇₇ (psig)	P ₁₇₈ (psig)	P ₁₇₉ (psig)	P ₁₈₀ (psig)	P ₁₈₁ (psig)	P ₁₈₂ (psig)	P ₁₈₃ (psig)	P ₁₈₄ (psig)	P ₁₈₅ (psig)	P ₁₈₆ (psig)	P ₁₈₇ (psig)	P ₁₈₈ (psig)	P ₁₈₉ (psig)	P ₁₉₀ (psig)	P ₁₉₁ (psig)	P ₁₉₂ (psig)	P ₁₉₃ (psig)	P ₁₉₄ (psig)	P ₁₉₅ (psig)	P ₁₉₆ (psig)	P ₁₉₇ (psig)	P ₁₉₈ (psig)	P ₁₉₉ (psig)	P ₂₀₀ (psig)	P ₂₀₁ (psig)	P ₂₀₂ (psig)	P ₂₀₃ (psig)	P ₂₀₄ (psig)	P ₂₀₅ (psig)	P ₂₀₆ (psig)	P ₂₀₇ (psig)	P ₂₀₈ (psig)	P ₂₀₉ (psig)	P ₂₁₀ (psig)	P ₂₁₁ (psig)	P ₂₁₂ (psig)	P ₂₁₃ (psig)	P ₂₁₄ (psig)	P ₂₁₅ (psig)	P ₂₁₆ (psig)	P ₂₁₇ (psig)	P ₂₁₈ (psig)	P ₂₁₉ (psig)	P ₂₂₀ (psig)	P ₂₂₁ (psig)	P ₂₂₂ (psig)	P ₂₂₃ (psig)	P ₂₂₄ (psig)	P ₂₂₅ (psig)	P ₂₂₆ (psig)	P ₂₂₇ (psig)	P ₂₂₈ (psig)	P ₂₂₉ (psig)	P ₂₃₀ (psig)	P ₂₃₁ (psig)	P ₂₃₂ (psig)	P ₂₃₃ (psig)	P ₂₃₄ (psig)	P ₂₃₅ (psig)	P ₂₃₆ (psig)	P ₂₃₇ (psig)	P ₂₃₈ (psig)	P ₂₃₉ (psig)	P ₂₄₀ (psig)	P ₂₄₁ (psig)	P ₂₄₂ (psig)	P ₂₄₃ (psig)	P ₂₄₄ (psig)	P ₂₄₅ (psig)	P ₂₄₆ (psig)	P ₂₄₇ (psig)	P ₂₄₈ (psig)	P ₂₄₉ (psig)	P ₂₅₀ (psig)	P ₂₅₁ (psig)	P ₂₅₂ (psig)	P ₂₅₃ (psig)	P ₂₅₄ (psig)	P ₂₅₅ (psig)	P ₂₅₆ (psig)	P ₂₅₇ (psig)	P ₂₅₈ (psig)	P ₂₅₉ (psig)	P ₂₆₀ (psig)	P ₂₆₁ (psig)	P ₂₆₂ (psig)	P ₂₆₃ (psig)	P ₂₆₄ (psig)	P ₂₆₅ (psig)	P ₂₆₆ (psig)	P ₂₆₇ (psig)	P ₂₆₈ (psig)	P ₂₆₉ (psig)	P ₂₇₀ (psig)	P ₂₇₁ (psig)	P ₂₇₂ (psig)	P ₂₇₃ (psig)	P ₂₇₄ (psig)	P ₂₇₅ (psig)	P ₂₇₆ (psig)	P ₂₇₇ (psig)	P ₂₇₈ (psig)	P ₂₇₉ (psig)	P ₂₈₀ (psig)	P ₂₈₁ (psig)	P ₂₈₂ (psig)	P ₂₈₃ (psig)	P ₂₈₄ (psig)	P ₂₈₅ (psig)	P ₂₈₆ (psig)	P ₂₈₇ (psig)	P ₂₈₈ (psig)	P ₂₈₉ (psig)	P ₂₉₀ (psig)	P ₂₉₁ (psig)	P ₂₉₂ (psig)	P ₂₉₃ (psig)	P ₂₉₄ (psig)	P ₂₉₅ (psig)	P ₂₉₆ (psig)	P ₂₉₇ (psig)	P ₂₉₈ (psig)	P ₂₉₉ (psig)	P ₃₀₀ (psig)	P ₃₀₁ (psig)	P ₃₀₂ (psig)	P ₃₀₃ (psig)	P ₃₀₄ (psig)	P ₃₀₅ (psig)	P ₃₀₆ (psig)	P ₃₀₇ (psig)	P ₃₀₈ (psig)	P ₃₀₉ (psig)	P ₃₁₀ (psig)	P ₃₁₁ (psig)	P ₃₁₂ (psig)	P ₃₁₃ (psig)	P ₃₁₄ (psig)	P ₃₁₅ (psig)	P ₃₁₆ (psig)	P ₃₁₇ (psig)	P ₃₁₈ (psig)	P ₃₁₉ (psig)	P ₃₂₀ (psig)	P ₃₂₁ (psig)	P ₃₂₂ (psig)	P ₃₂₃ (psig)	P ₃₂₄ (psig)	P ₃₂₅ (psig)	P ₃₂₆ (psig)	P ₃₂₇ (psig)	P ₃₂₈ (psig)	P ₃₂₉ (psig)	P ₃₃₀ (psig)	P ₃₃₁ (psig)	P ₃₃₂ (psig)	P ₃₃₃ (psig)	P ₃₃₄ (psig)	P ₃₃₅ (psig)	P ₃₃₆ (psig)	P ₃₃₇ (psig)	P ₃₃₈ (psig)	P ₃₃₉ (psig)	P ₃₄₀ (psig)	P ₃₄₁ (psig)	P ₃₄₂ (psig)	P ₃₄₃ (psig)	P ₃₄₄ (psig)	P ₃₄₅ (psig)	P ₃₄₆ (psig)	P ₃₄₇ (psig)	P ₃₄₈ (psig)	P ₃₄₉ (psig)	P ₃₅₀ (psig)	P ₃₅₁ (psig)	P ₃₅₂ (psig)	P ₃₅₃ (psig)	P ₃₅₄ (psig)	P ₃₅₅ (psig)	P ₃₅₆ (psig)	P ₃₅₇ (psig)	P ₃₅₈ (psig)	P ₃₅₉ (psig)	P ₃₆₀ (psig)	P ₃₆₁ (psig)	P ₃₆₂ (psig)	P ₃₆₃ (psig)	P ₃₆₄ (psig)	P ₃₆₅ (psig)	P ₃₆₆ (psig)	P ₃₆₇ (psig)	P ₃₆₈ (psig)	P ₃₆₉ (psig)	P ₃₇₀ (psig)	P ₃₇₁ (psig)	P ₃₇₂ (psig)	P ₃₇₃ (psig)	P ₃₇₄ (psig)	P ₃₇₅ (psig)	P ₃₇₆ (psig)	P ₃₇₇ (psig)	P ₃₇₈ (psig)	P ₃₇₉ (psig)	P ₃₈₀ (psig)	P ₃₈₁ (psig)	P ₃₈₂ (psig)	P ₃₈₃ (psig)	P ₃₈₄ (psig)	P ₃₈₅ (psig)	P ₃₈₆ (psig)	P ₃₈₇ (psig)	P ₃₈₈ (psig)	P ₃₈₉ (psig)	P ₃₉₀ (psig)	P ₃₉₁ (psig)	P ₃₉₂ (psig)	P ₃₉₃ (psig)	P ₃₉₄ (psig)	P ₃₉₅ (psig)	P ₃₉₆ (psig)	P ₃₉₇ (psig)	P ₃₉₈ (psig)	P ₃₉₉ (psig)	P ₄₀₀ (psig)	P ₄₀₁ (psig)	P ₄₀₂ (psig)	P ₄₀₃ (psig)	P ₄₀₄ (psig)	P ₄₀₅ (psig)	P ₄₀₆ (psig)	P ₄₀₇ (psig)	P ₄₀₈ (psig)	P ₄₀₉ (psig)	P ₄₁₀ (psig)	P ₄₁₁ (psig)	P ₄₁₂ (psig)	P ₄₁₃ (psig)	P ₄₁₄ (psig)	P ₄₁₅ (psig)	P ₄₁₆ (psig)	P ₄₁₇ (psig)	P ₄₁₈ (psig)	P ₄₁₉ (psig)	P ₄₂₀ (psig)	P ₄₂₁ (psig)	P ₄₂₂ (psig)	P ₄₂₃ (psig)	P ₄₂₄ (psig)	P ₄₂₅ (psig)	P ₄₂₆ (psig)	P ₄₂₇ (psig)	P ₄₂₈ (psig)	P ₄₂₉ (psig)	P ₄₃₀ (psig)	P ₄₃₁ (psig)	P ₄₃₂ (psig)	P ₄₃₃ (psig)	P ₄₃₄ (psig)	P ₄₃₅ (psig)	P ₄₃₆ (psig)	P ₄₃₇ (psig)	P ₄₃₈ (psig)	P ₄₃₉ (psig)	P ₄₄₀ (psig)	P ₄₄₁ (psig)	P ₄₄₂ (psig)	P ₄₄₃ (psig)	P ₄₄₄ (psig)	P ₄₄₅ (psig)	P ₄₄₆ (psig)	P ₄₄₇ (psig)	P ₄₄₈ (psig)	P ₄₄₉ (psig)	P ₄₅₀ (psig)	P ₄₅₁ (psig)	P ₄₅₂ (psig)	P ₄₅₃ (psig)	P ₄₅₄ (psig)	P ₄₅₅ (psig)	P ₄₅₆ (psig)	P ₄₅₇ (psig)	P ₄₅₈ (psig)	P ₄₅₉ (psig)	P ₄₆₀ (psig)	P ₄₆₁ (psig)	P ₄₆₂ (psig)	P ₄₆₃ (psig)	P ₄₆₄ (psig)	P ₄₆₅ (psig)	P ₄₆₆ (psig)	P ₄₆₇ (psig)	P ₄₆₈ (psig)	P ₄₆₉ (psig)	P ₄₇₀ (psig)	P ₄₇₁ (psig)	P ₄₇₂ (psig)	P ₄₇₃ (psig)	P ₄₇₄ (psig)	P ₄₇₅ (psig)	P ₄₇₆ (psig)	P ₄₇₇ (psig)	P ₄₇₈ (psig)	P ₄₇₉ (psig)	P ₄₈₀ (psig)	P ₄₈₁ (psig)	P ₄₈₂ (psig)	P ₄₈₃ (psig)	P ₄₈₄ (psig)	P ₄₈₅ (psig)	P ₄₈₆ (psig)	P ₄₈₇ (psig)	P ₄₈₈ (psig)	P ₄₈₉ (psig)	P ₄₉₀ (psig)	P ₄₉₁ (psig)	P ₄₉₂ (psig)	P ₄₉₃ (psig)	P ₄₉₄ (psig)	P ₄₉₅ (psig)	P ₄₉₆ (psig)	P ₄₉₇ (psig)	P ₄₉₈ (psig)	P ₄₉₉ (psig)	P ₅₀₀ (psig)	P ₅₀₁ (psig)	P ₅₀₂ (psig)	P ₅₀₃ (psig)	P ₅₀₄ (psig)	P ₅₀₅ (psig)	P ₅₀₆ (psig)	P ₅₀₇ (psig)	P ₅₀₈ (psig)	P ₅₀₉ (psig)	P ₅₁₀ (psig)	P ₅₁₁ (psig)	P ₅₁₂ (psig)	P ₅₁₃ (psig)	P ₅₁₄ (psig)	P ₅₁₅ (psig)	P ₅₁₆ (psig)	P ₅₁₇ (psig)	P ₅₁₈ (psig)	P ₅₁₉ (psig)	P ₅₂₀ (psig)	P ₅₂₁ (psig)	P ₅₂₂ (psig)	P ₅₂₃ (psig)	P ₅₂₄ (psig)	P ₅₂₅ (psig)	P ₅₂₆ (psig)	P ₅₂₇ (psig)	P ₅₂₈ (psig)	P ₅₂₉ (psig)	P ₅₃₀ (psig)	P ₅₃₁ (psig)	P ₅₃₂ (psig)	P ₅₃₃ (psig)	P ₅₃₄ (psig)	P ₅₃₅ (psig)	P ₅₃₆ (psig)	P ₅₃₇ (psig)	P ₅₃₈ (psig)	P

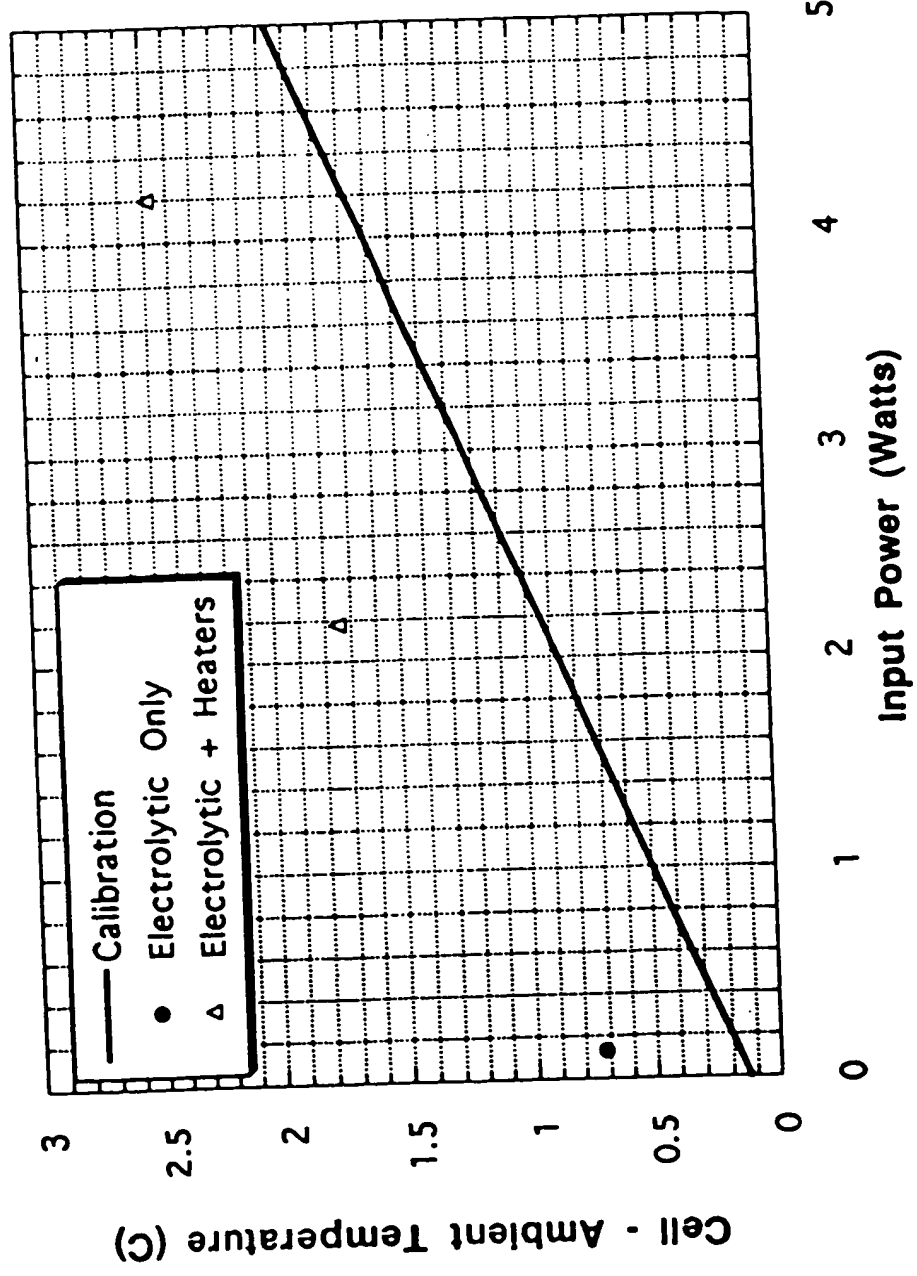


File Name (Run No.)	V (Volts)	I (Amps)	P (Watts)	Duty Cycle	Line Bus V (Hz)	Cell (C)	Ambient (C)	ΔI (C)	H ₂ O Power Correction (watts)	P _{in} (net in/out) (watts)	Output Power (watts)	Δ Power (watts)	Output P _o (F=1)	Output P _o (times)
un332wet lid	3.576	7.032	25.146	100%	0	25.718	19.948	5.77	0.0472	13.965	16.049	2.084	114.9%	121.1%
un333wet lid	3.531	7.019	24.784	100%	0	25.150	19.687	5.571	0.0355	13.831	15.486	1.655	112.0%	119.9%
un335wet lid	1.950	0.991	1.932	100%	0	20.774	20.176	0.598	0.0064	0.464	1.681	1.217	362.0%	365.3%
un326 - This run no. accidentally skipped														
un337wet lid	2.951	3.182	3.947	20%	6	21.336	19.754	1.582	0.0096	2.069	4.372	2.303	211.3%	N/A
un338wet lid	2.229	4.007	7.188	20%	6	22.352	19.987	2.365	0.0167	4.192	6.583	2.391	157.0%	N/A
un339wet lid	2.493	7.989	14.130	20%	6	23.96	19.725	4.235	0.0308	9.418	11.73	2.312	124.6%	N/A
un340wet lid	2.139	5.819	7.211	10%	6	21.604	19.615	2.268	0.0089	4.957	6.26	1.303	126.3%	N/A
un341	2.998	11.266	29.354	40%	6	27.271	19.077	7.294	0.0893	19.221	20.391	1.170	106.1%	N/A
un342	1.799	2.027	1.599	10%	6	21.325	19.601	1.524	0.0040	0.846	4.213	3.367	498.2%	N/A
un343	2.479	8.110	14.362	20%	6	24.323	19.927	4.496	0.0317	9.508	12.458	2.950	131.0%	N/A
un344	2.494	8.103	14.370	20%	6	24.827	20.065	4.762	0.0285	9.798	13.205	3.407	134.8%	N/A
un345	2.908	14.927	34.014	20%	6	29.859	20.266	9.591	0.0732	25.335	27.037	1.702	106.7%	N/A
un346	1.711	0.839	0.700	20%	6	21.208	20.198	1.01	0.0023	0.275	2.805	2.530	1019.6%	N/A
un348	3.233	6.001	25.667	100%	0	27.298	20.542	6.756	0.0632	14.625	18.852	4.027	127.2%	155.7%

4/20/85

File Name Run No.)	Bar. Pressure (Torr)	Bar. Pressure (calibrated)	P _{cell} (psig)	P ₁ (psig)	P ₁ (psia)	P ₂ (psig)	P ₂ (psia)	P _{diff} (psid)	I ₁ (C)	Measured Flowrate (cc/min) (fully corr.)	Paradey Efficiency	Data Taken Over Time Period (min)
Run332/next lid	766.86	761.83	3.7180	3.7100	16.22	3.6900	16.20	0.0200	20.186	73.11	92.75%	3300-3800
Run333/next lid	776.38	768.88	6.8730	6.8710	20.71	6.8552	20.69	0.0158	19.833	71.51	90.88%	2000-2500
Run335/next lid	767.86	760.88	1.8190	1.8200	16.31	1.8165	16.31	0.0035	20.443	10.85	97.87%	8600-7200
Run338 This run just a temp run-no data												
Run337/next lid	780.10	772.25	0.7218	0.7238	15.83	0.8300	15.53	0.0938	20.087	14.01	39.28%	3000-3800
Run338/next lid	787.89	780.52	0.6398	0.6416	15.32	0.5442	15.22	0.0974	20.235	22.20	40.38%	3200-3500
Run339/next lid	770.28	762.82	0.0534	0.0548	14.78	0.0428	14.77	0.0120	19.908	34.52	38.64%	2500-2800
Run340/next lid	785.41	758.14	2.2250	2.2320	16.86	2.2289	16.86	0.0031	19.849	16.51	25.31%	3400-3600
Run341	784.55	767.31	0.4358	0.4415	15.08	0.4193	15.04	0.0222	20.010	66.76	52.86%	1800-2000
Run342	782.89	756.72	0.6187	0.6151	15.20	0.5845	15.17	0.0308	20.066	5.82	24.73%	1900-2000
Run343	788.43	781.04	0.2439	0.2458	14.93	0.2382	14.93	0.0076	20.102	35.80	39.18%	3400-3600
Run344	783.41	756.22	0.8458	0.8492	15.44	0.8410	15.44	0.0072	20.341	33.34	36.70%	2500-2800
Run346	772.93	765.36	0.4704	0.4724	16.24	0.4825	16.22	0.0189	20.466	81.89	36.87%	4160-4250
Run348	776.32	767.88	0.3366	0.3381	16.16	0.3388	16.16	0.0023	20.509	3.19	33.94%	2800-2800
Run348 This run just a temp run-no data												
Run348	786.38	769.07	0.4309	0.4323	16.08	0.4001	16.05	0.0322	20.714	82.04	91.47%	6000-6500

0.278 Ampere Data



MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LINCOLN LABORATORY

2 May 1995

TO: Ad Hoc Committee Distribution
FROM: C. W. Haldeman *CWH*
SUBJECT: Additional Material

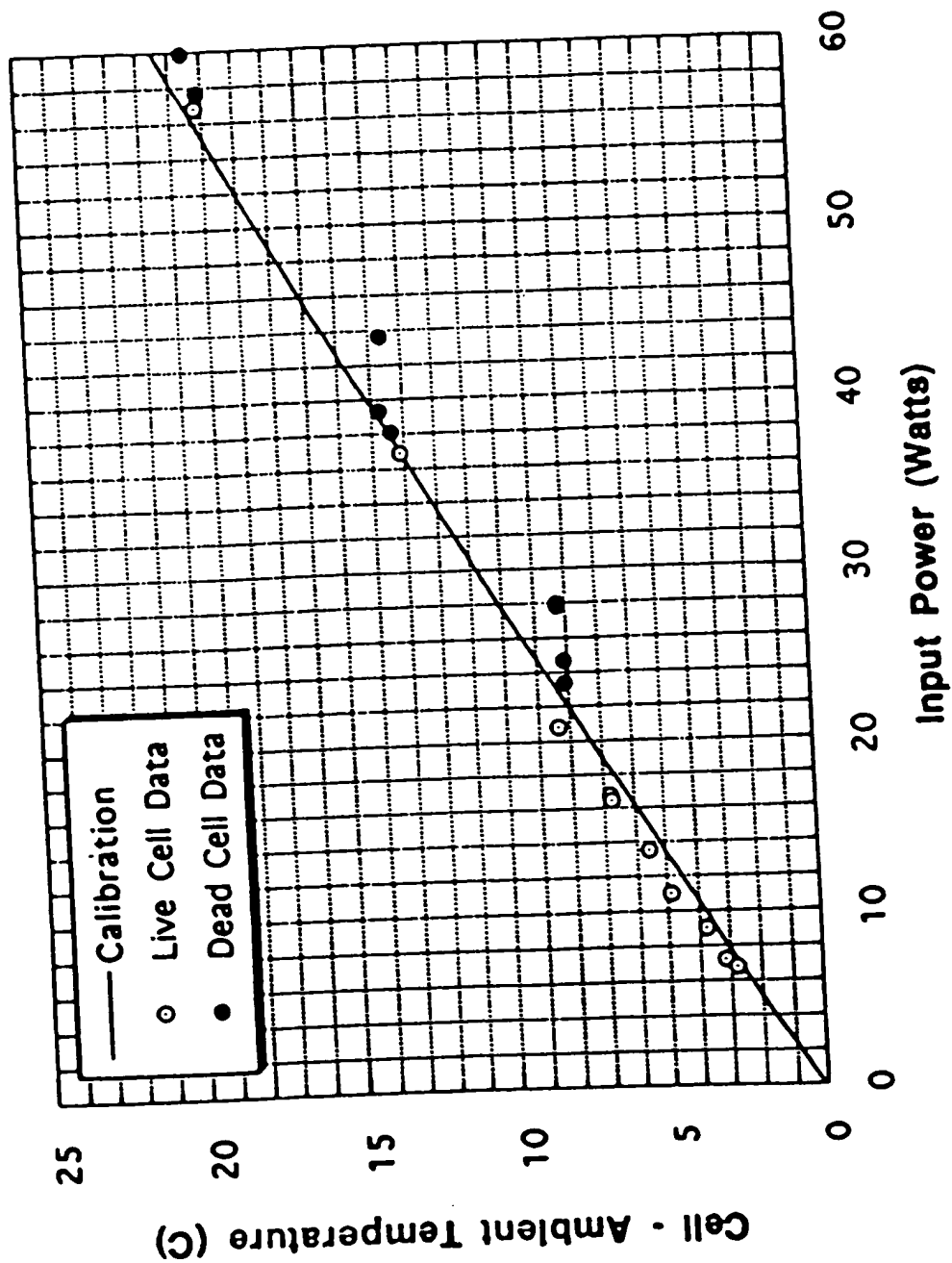
You should have all received my viewgraphs from the 25 April meeting. At that meeting Marv and Ron requested that I replot the data from the new cell (Cell 4) in terms of excess power vs. net input power. This has been done and is attached. The large scatter seems to indicate that the excess power is not a function of net input or at least has a stronger dependence on some variable not controlled. Also requested and included is the old data from Cell 3 which includes data before and after the power failure. The calibration curve is the same for both windings of the cell and includes both calibration and recalibration results.

Since the data now includes both Cell 3 and 4, I replotted the Cell 4 results to avoid confusion. This is the same plot in the presentation which was entitled "Electrolytic Cell Data Results." Please add these figures to the package.

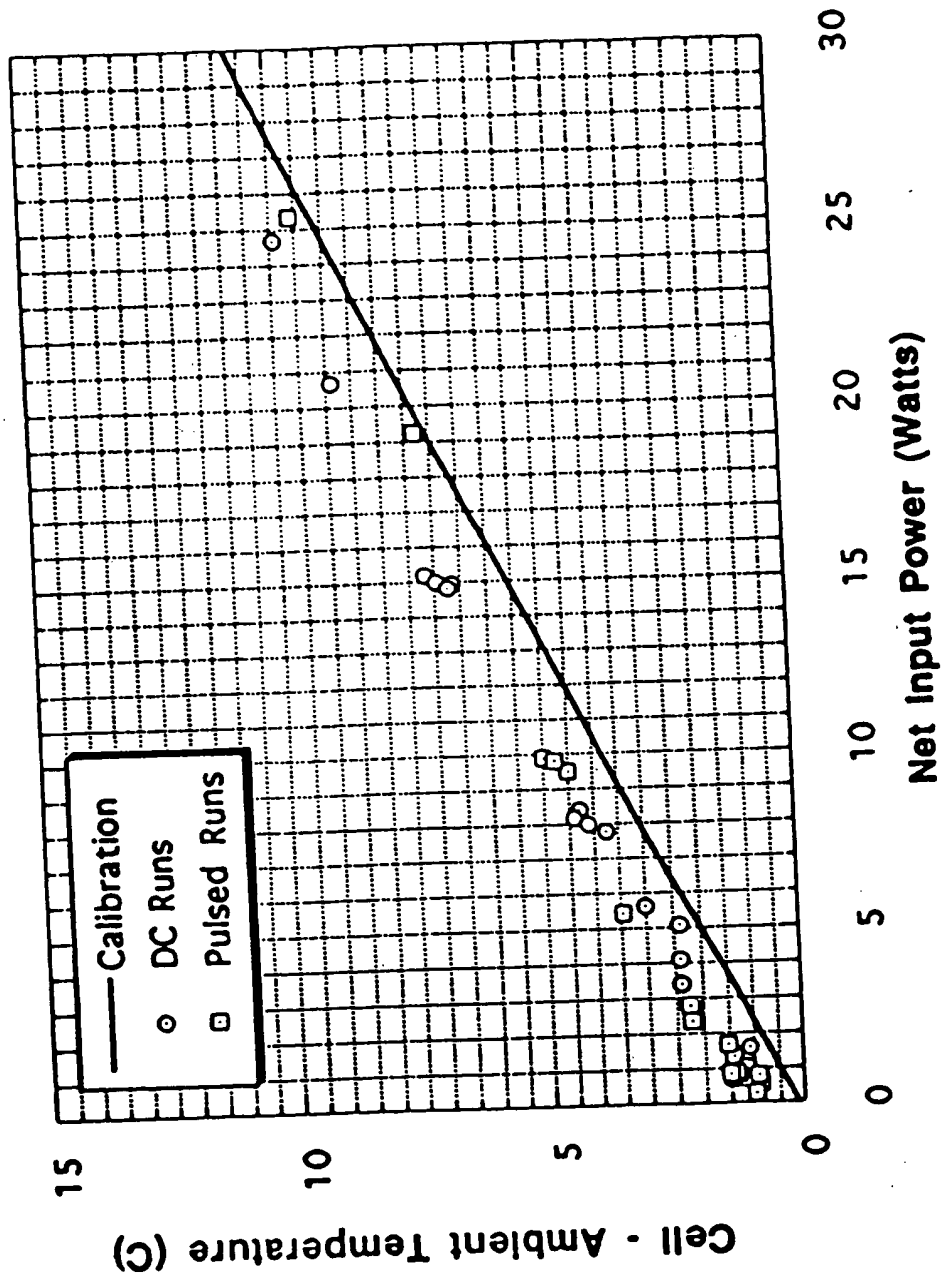
CWH:jf
Attachments

FOR LABORATORY USE ONLY

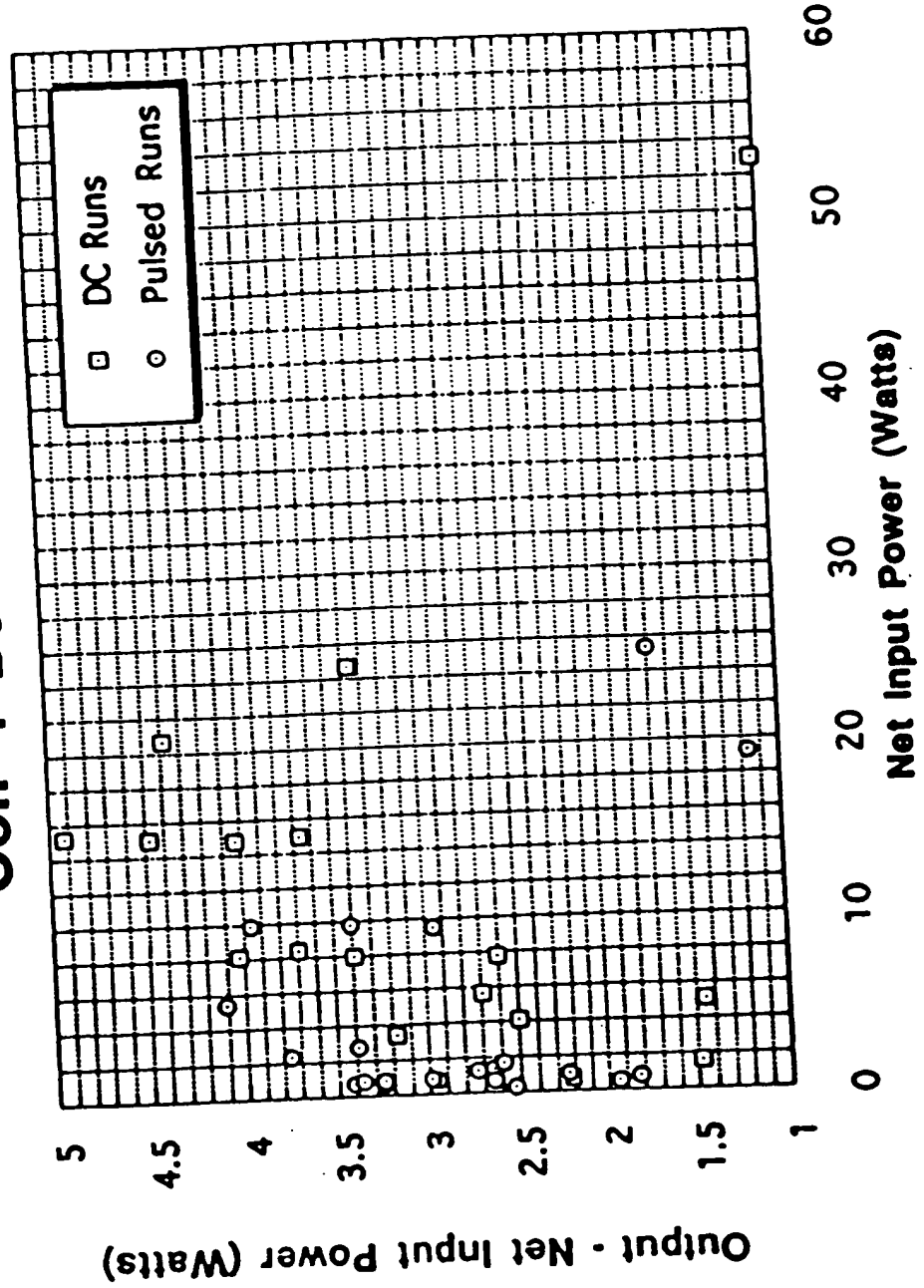
Cell 3 Data Results



Cell 4 Data Results

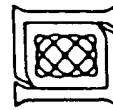


Cell 4 Data Results



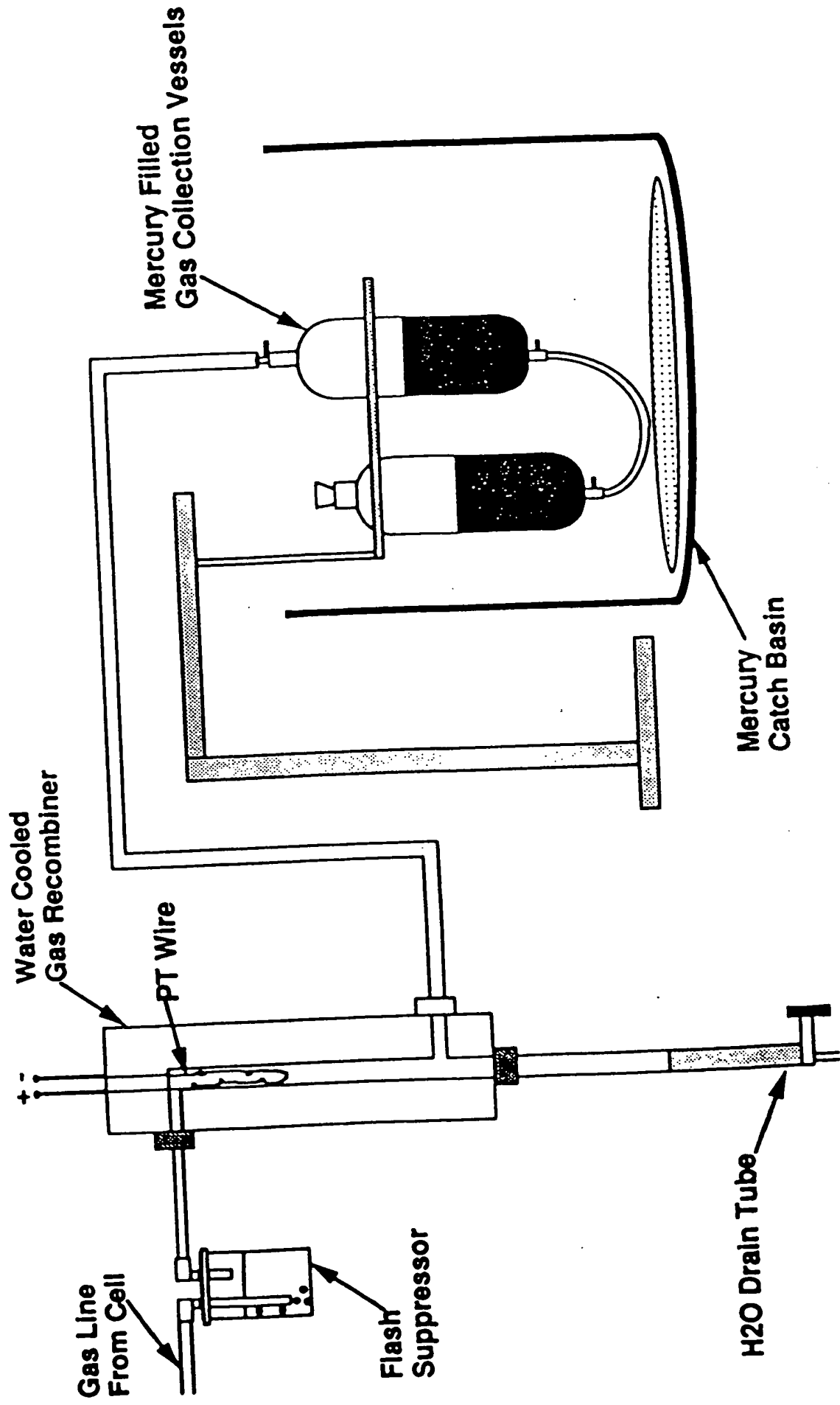
GAS MEASUREMENTS

- **CHEMICAL ABSORPTION**
 - BURRELL WET ANALYZER
- **MASS SPECTROMETER**
 - INFICON QUADRAPOLE - 102 VOLT ENERGY
- **CRYO CONDENSATION**

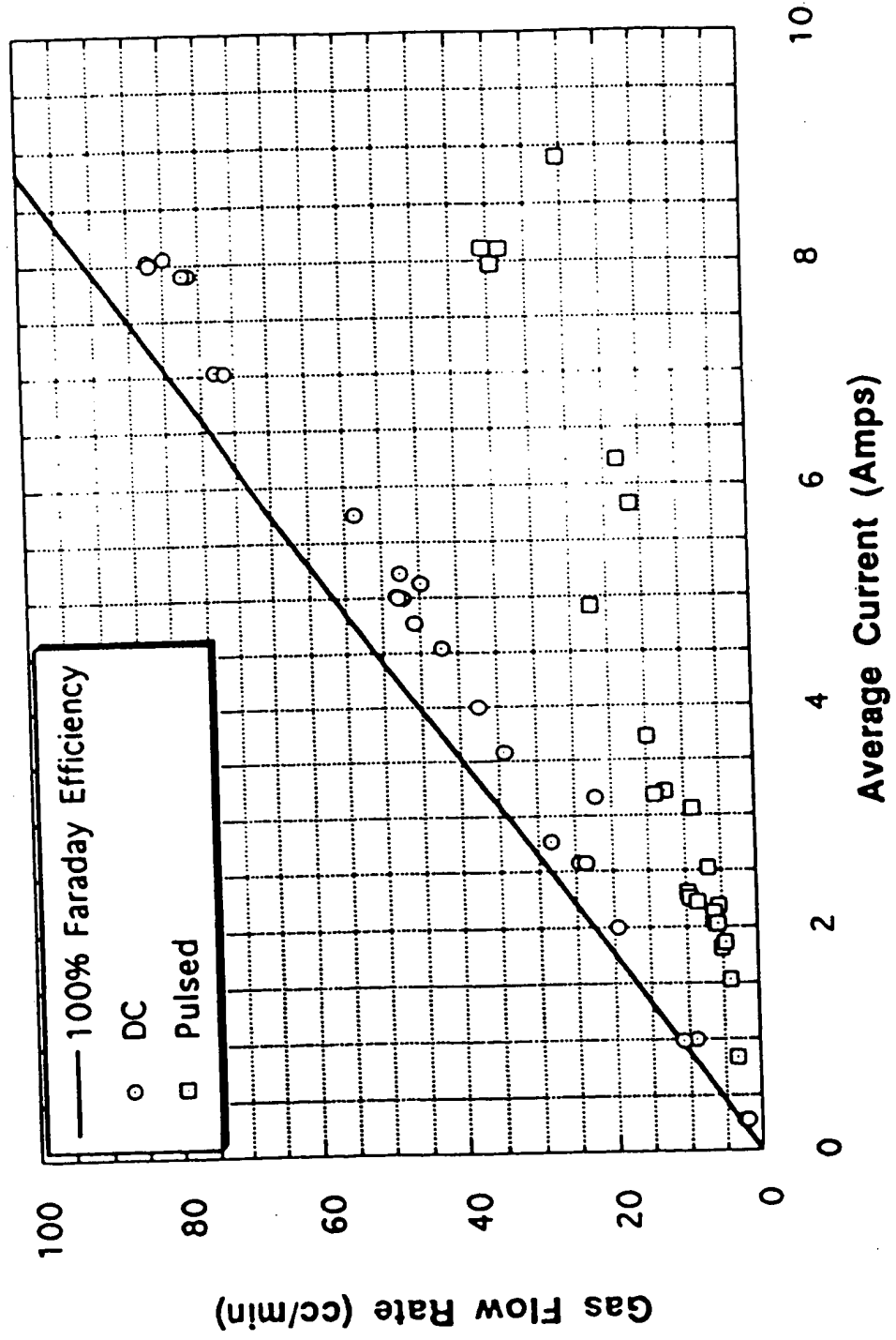


gmj/chuck/4/20

Electrolytic Cell Current Gas Collection System



Cell Gas Production



GAS WET ANALYSIS **BURRELL ABSORPTION TUBE ANALYZER**

GAS TESTED FOR	ABSORBENT
CO₂	KOH sol
O₂	C_rCl₂ sol
H₂	HOT (300°C) C_uO

WET ANALYSIS RESULTS

PERCENT

SAMPLE

CO₂ O₂

H₂

RESIDUE

AIR

0

21

0

79

RAW CELL GAS

0

32

67

01

RECOMBINED CELL GAS
MANY SAMPLES

0

18 → 22

0 → 0.2

BALANCE 78 → 82
CALLED PROCESSED
CELL GAS

MASS SPEC ANALYSIS OF PROCESSED CELL GAS SHOWS

N₂, A, H₂O

HYDRO-CATALYSIS CLAIMS TO HAVE FOUND 1-2% H₂



weufchuck/4/20

RECOMBINER RESULTS

• GAS GENERATION 2 TO 100 cc/minute
 2.8 TO 144 l/day

• RECOMBINED WATER CHECKS OUT GAS MEASUREMENT
- $\pm 1\%$

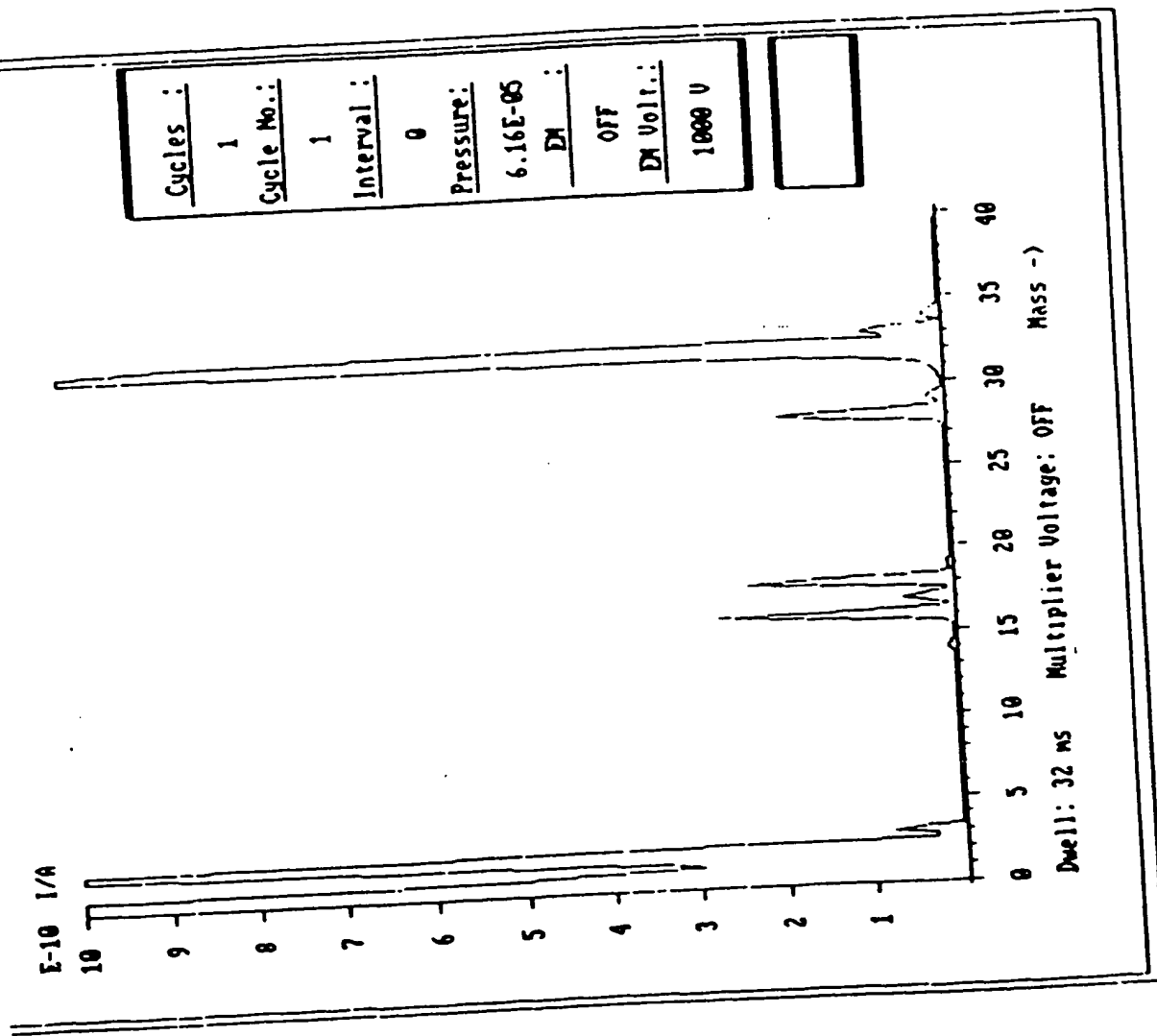
• RESIDUAL GAS FROM RECOMBINER - 50 → 100 cc/day
- 1.8% TO 0.1% OF TOTAL GAS FLOW
- NEARLY 100% CONDENSED OVER LN₂



rr/jchuck/4/20

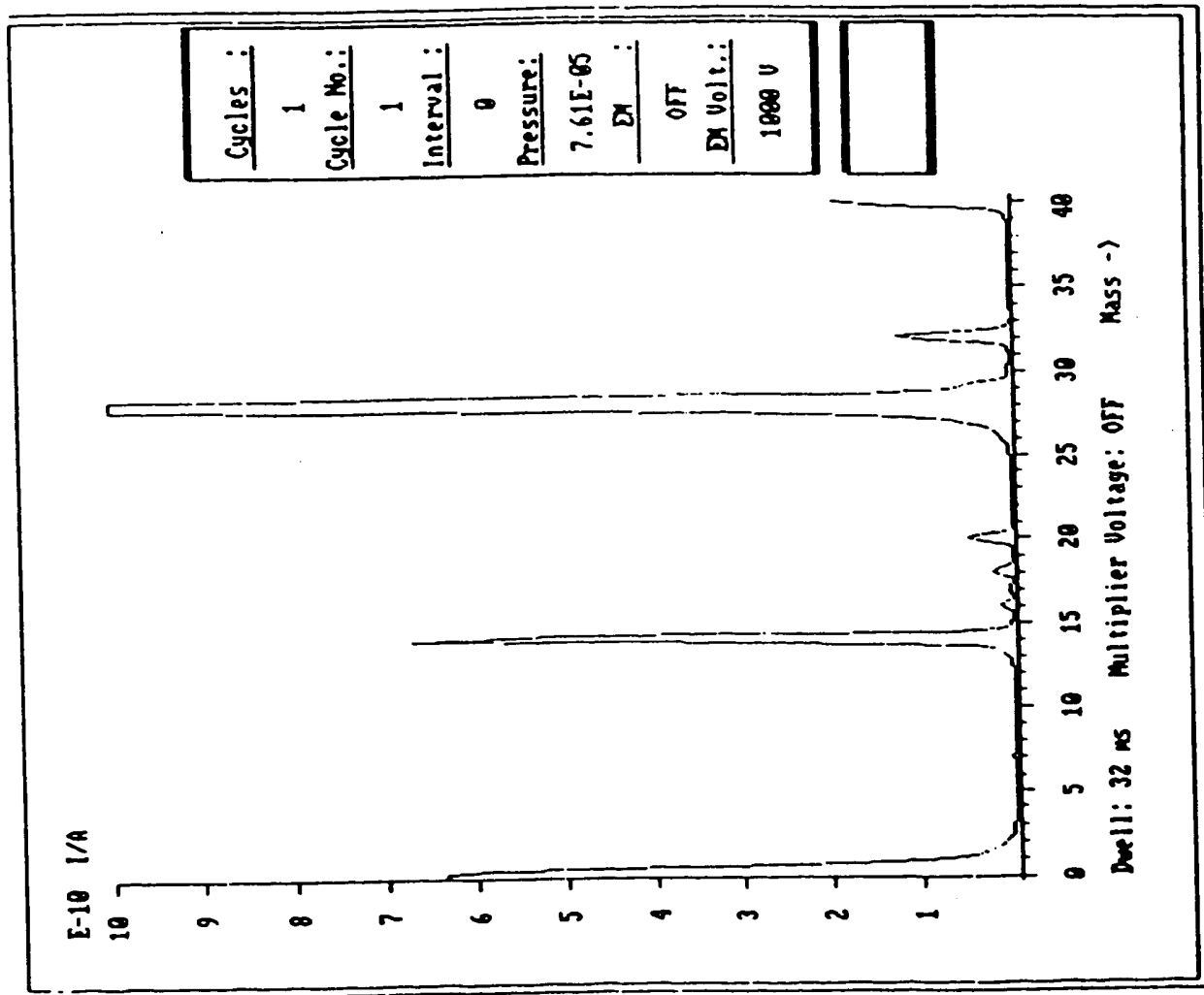
"RAW CELL GAS"

RUN 334



"PROCESSED CELL GAS"

RUNS 332 - 334



"PROCESSED CELL GAS RUNS 332 - 334

E-10 I/A

10

9

8

7

6

5

4

3

2

1

0

1

2

3

4

5

6

7

8

9

10

Dwell: 32 ms

Multiplier Voltage: OFF

Mass ->

Cycles :

1

Cycle No.:

1

Interval :

0

Pressure:

7.90E-05

DM :

OFF

EM Volt.:

1000 V

ISOTOPIC RATIOS - HD/H₂

SAMPLE	TEST PRESSURE TORR	3/2 RATIO
BOTTLE HYDROGEN	1.3 x 10 ⁻⁴	0.052
LAB DI WATER	9.8 x 10 ⁻⁵	0.035
CELL GAS	9.7 x 10 ⁻⁵	0.025
RECOMBINER WATER	8.9 x 10 ⁻⁵	0.031
CELL ELECTROLYTE	9.9 x 10 ⁻⁵	0.044

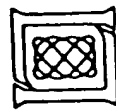


Ir/ychuc W/4/20

WHAT TO DO NEXT FOR HIGHER ENERGY



- STUDY GAS CELL WHICH HAS MUCH HIGHER ENERGY DENSITY
 - HYDROCATALYSIS WILL PAY - - CRDA ?
- TEST PALLADIUM - SILVER COATED NICKEL WIRE WITH D_2O SYSTEM ACC CONTINUATION ?
- INVESTIGATE TUBULAR REACTOR USING PALLADIUM - SILVER



CONCLUSIONS

- EXCESS ENERGY IS PRESENT AT 0.5 TO 5 W LEVEL
0.5 TO 2.5° ABOVE CALIBRATION

TEMPERATURE CALIBRATIONS $\pm .02^{\circ}\text{C}$

- GAINS ARE HIGH 5 TO 14 x NET INPUT
1.5 TO 4 x GROSS VI INPUT

BUT ONLY AT 1-4 W EXCESS

- SOURCE IS NOT DETERMINED

- LOWER STATE HYDROGEN WAS NOT FOUND - WHY ?

- A) NOT THERE
- B) CHEMICALLY MORE REACTIVE THAN REPORTED
EASILY ABSORBED IN METAL

- ISOTOPIC RATIOS CONSISTENT WITH ELECTROLYTIC CELL
DECOMPOSITION OF WATER

- CANNOT PROVE OR DISPROVE POSSIBLE EXPLANATIONS
FOR EXCESS HEAT



c/structure/4/20